

Appl. No. 10/642,805  
Amdt. dated September 6, 2005  
Reply to Office Action of May 3, 2005

## **REMARKS / ARGUMENTS**

### ***Summary of the Present Invention***

The present application claims a method for producing a catalyst for use in the high temperature shift water-gas shift reaction. The method involves preparing the catalyst by starting with the preparation of a high purity iron precursor. The catalyst particles prepared with the high purity iron precursor are essentially free of contaminants, and have essentially spherical particle shape and a relatively small particle size distribution range.

### ***Remarks Regarding Double Patenting and Claims Rejected Under 35 USC §112***

The Examiner has provisionally rejected claims 1 – 21 under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1 – 35 of copending Application Number 10/343,935. Concurrent with the filing of this Amendment, Applicant is filing a terminal disclaimer with the Commissioner of Patents, a copy of which is attached.

The Examiner has rejected claims 1 – 21 under 35 U.S.C. §112, second paragraph. The Examiner notes that Claims 1, 10 and 17 recite the limitation “said catalyst comprising from about 60 wt% to about 95 wt%  $\text{Fe}_2\text{O}_3$ , from about 0 wt% to about 20 wt%  $\text{Cr}_2\text{O}_3$ , and from about 0 wt% to about 10 wt% CuO.” Applicant has amended independent Claims 1, 10 and 17 to more particularly point out that chromium in the form of an oxide is present in the catalyst. Applicant has deleted the reference to the copper oxide within the independent Claims 1 and 17, and has amended the wording referring to the CuO in Claim 10 to remove the reference to 0 wt% CuO. It is Applicant’s belief that these amendments do not add new matter to the Claims.

More specifically, in the present application, independent Claims 1, 10 and 17 have been amended to more particularly state that the catalyst comprises from about 60 wt% to about 95 wt%  $\text{Fe}_2\text{O}_3$  and from about 0.1 wt% to about 20 wt% chromium in the form of the oxide  $\text{Cr}_2\text{O}_3$ . The basis for the amendment specifying that the chromium is in the form of the oxide and for setting the lower limit of  $\text{Cr}_2\text{O}_3$  can be found in the original specification at page 7, line 6 (with chromium cited as one of the stabilizing promoters intended to be covered on page 6, line 24).

Claims 1 and 10 have also been amended to more particularly point out that the chromium may be optionally added in the form of chromic acid flakes, to provide up to about 20 wt%  $\text{Cr}_2\text{O}_3$  to the finished catalyst. The basis for this amendment is found at page 10, lines 13 – 14. It should be noted that the chromic acid flakes are an optional form of addition for the chromium because the chromium can be added in step 1e as a promoter (chromium is listed as one of the members of the group from which promoters may be selected in Claim 4).

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Claims 1 and 17 have also been amended to delete the reference to copper oxide as an optional component in the catalyst.

Claims 1 and 10 have been amended to change the term "oxidative agent" to "oxidizing agent". The term "oxidizing agent" is the more commonly used form and the wording in Claim 1 is now consistent with the wording in the specification and in Claims 8, 14, 19 and 20. It is Applicant's belief that this amendment does not add new matter to the Claims.

Claims 9 and 18 have been amended to include CuO as one of the members of the group from which the further components may be added to the catalyst. Claims 9 and 18 have also been amended to more particularly state that this component is added to the milled iron slurry with said promoter. The basis for these amendments are found at page 6, lines 8 – 9 and page 7, lines 11 – 13 and page 7, line 18 – page 8, line 7. It is Applicant's belief that these amendments do not add new matter to the Claims.

Claims 1 – 21 remain in the application. Claims 2 – 9 depend from independent Claim 1, Claims 11 – 16 depend from independent Claim 10, and Claims 18 – 21 depend from independent Claim 17.

***Remarks Regarding Claims Rejected Under 35 USC §102(b)***

The Examiner has rejected Claims 17 – 21 under 35 U.S.C §102(b) as anticipated by, or in the alternative, under 35 U.S.C §103(a) as obvious over Huang et al (U.S. Patent 4,861,745, "the '745 patent". (Please note: the Examiner's rejection refers to U.S. Patent 4,862,745 but this patent is not issued to Huang, et al. Applicant has assumed that this was a typographical error and Examiner intended to refer to U.S. Patent 4,861,745, as listed in the Notice of References Cited.)). The '745 patent teaches and claims a catalyst for high temperature water gas shift reactions. The catalyst comprises iron oxide, chromium oxide and copper oxide.

Similar to the catalyst of the '745 patent, the catalyst of the present invention comprises iron oxide and chromium oxide and is intended for use in high temperature water gas shift reactions. However, the present invention teaches and claims a method for preparation of the catalyst that differs significantly from the method taught in the '745 patent.

Specifically, the catalyst of the '745 patent is prepared by "dipping an iron oxide-chromium oxide catalyst in an aqueous copper salt solution, the concentration of the solution being sufficient to obtain about 0.2 to about 10 weight percent copper oxide on the finished catalyst, after drying and calcining" (column 2, lines 20 – 26). It is stated that "[t]he iron oxide-chromium oxide catalyst, prior to modification with copper oxide, is made by a conventional process which involves forming an aqueous solution of ferrous sulfate and sodium bichromate, precipitating the salts with sodium hydroxide, followed by filtering, washing, calcining, and tableting. This procedure is described in detail in U.S. Pat. No. 4,598,062..." (column 2, lines 45 – 51). U.S. Patent 4,598,062 teaches that "[a] precursor stage of

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the iron oxide-chromium oxide component is, e.g. a mixture of the hydroxides and/or oxide hydrates of iron and of chromium, in which the iron is present in bi and/or trivalent form and the chromium generally in trivalent form." (column 2, lines 62 – 66).

The method of the present invention requires the use of a high purity iron oxide for the preparation of the catalyst. This high purity iron oxide is prepared *in situ* and the preparation requires that an iron metal be added to an aqueous organic acid, and then the iron-acid solution is treated with an oxidizing agent until the iron metal is consumed. The iron oxide remains in the form of a milled slurry when promoters, such as chromium or copper, are added. The resulting catalyst particles have an essentially spherical particle shape and a relatively small particle size distribution range and relatively high surface areas (up to about 100 m<sup>2</sup>/g), as compared to the catalysts made from the conventional process which produces catalyst particles that are needle-like in shape.

There is no teaching or suggestion in the '745 patent that a method other than the method taught in U.S. Patent 4,598,062 could be used to prepare a high temperature water gas shift iron-chromium catalyst. However, the method of the present invention does just that and produces a product with different physical characteristics, e.g. shape, than is produced by the '745 method. Thus, independent Claim 1 and its dependent Claims 2 – 9, independent Claim 10 and its dependent Claims 11 -16, and independent Claim 17 and its dependent Claims 18 – 21, are not anticipated nor obvious in view of U.S. Patent 4,861,745.

***Remarks Regarding Allowable Subject Matter and Citations***

The Examiner has not indicated that any claims are allowable in the application at present.

Applicant has made note of the prior art recited by the Examiner in the Notice of References Cited.

Applicant respectfully requests that a timely Notice of Allowance be issued in this case.

Respectfully submitted,

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Joan L. Simunic  
Reg. 43,125  
Tel: (503) 220-1184  
Fax: (502) 634-7724  
e-mail: [jsimunic@sud-chemieinc.com](mailto:jsimunic@sud-chemieinc.com)

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There is no teaching or suggestion in the '745 patent that a method other than the method taught in U.S. Patent 4,598,062 could be used to prepare a high temperature water gas shift iron-chromium catalyst. However, the method of the present invention does just that and produces a product with different physical characteristics, e.g. shape, than is produced by the '745 method. Thus, independent Claim 1 and its dependent Claims 2 - 9, independent Claim 10 and its dependent Claims 11 - 16, and independent Claim 17 and its dependent Claims 18 - 21, are not anticipated nor obvious in view of U.S. Patent 4,861,745.

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Reg. 43,125  
Tel: (505) 220-1184  
Fax: (505) 634-7724  
e-mail: [isimunic@acid-chemistry.com](mailto:isimunic@acid-chemistry.com)